ColorAnodized Finish for Architectural Aluminum

W. E. Cooke

A newly developed color anodized finish for Aluminum is based essentially upon the long established normal sulphuric acid electrolytic process. Over nine years of laboratory, plant and field testing and a number of installations throughout the world has established its ability to withstand ultraviolet radiation, oxidation, leaching, wear and the weather.

This new finish which can provide a myriad of colors is produced by a novel two-stage electrolytic process. The first step in this process is to subject the aluminum to the normal sulphuric acid anodizing bath. In the second step the anodized aluminum is colored by metal oxides obtained by AC electrolysis of solutions of appropriate metal salts. During the AC electrolysis the metal ions migrate through the clear, transparent, porous anodic coating and are deposited as insoluble oxides at the base of the pores in the anodic coating. The color anodized finish is then given the normal sealing treatment in boiling water or steam to close the pores in the anodic coating, thus isolating the color pigment from the environment. Mechanical and/or chemical pretreatments are applied prior to the first stage anodizing process.

The color of the anodized aluminum can be varied from light to dark by altering the time, voltage, or current in the electrolytic coloring bath, which affects the amount of colored metal oxide deposited. Special or controlled Aluminum alloys are not required in the process and the alloys used are usually AA1100, AA5005 and AA6063.

Potentially a wide range of colors is possible since there are some forty metal elements available. However, only a few metal salts have been developed thus far to the point of commercial exploitation. The present colors available are black, bronze, brown, beige and gold. Color matching on both sheet and extrusions can be specified to be within the range of approved samples.

For exterior applications, this new finish should be specified to meet or to exceed the minimum requirements of the Aluminum Association's Class I (A44) architectural anodic coating, minimum thickness 0.7 mil, and minimum weight 30 mg/sq. in. For interior applications specify AA designation A34.

The qualities most often sought in color anodized aluminum are color fastness and resistance to staining and pitting. The laboratory tests and field installations indicate that this finish commercially produced has excellent characteristics.

The fastness of the colors offered for commercial use has been determined by Weather-Ometer, Uviarc, oxidation, leaching, heat resistance and field exposure tests. There is no change in appearance when subjected to ultraviolet radiation after exposure for 1000 hours in the Atlas Model XW-R Dew Cycle Weather-Ometer. A more severe and rapid test for evaluating color fastness due to exposure to ultraviolet radiation is the Uviarc test. In this test, developed by the Chrysler Corporation, a specimen is placed 12 inches from a 1200 watt mercury vapor lamp. Usually more color loss is experienced in 96 hours in this test than in the 1000 hour Weather-Ometer exposure. The new anodized finish passes this test easily with no color loss. Oxidation which will normally oxidize practically all organic dyes and most inorganic pigments will not exidize the metal oxides used for this finish. The oxidation test is performed by immersing the unsealed color anodized finish in 30% hydrogen peroxide for 24 hours. No color loss was experienced by this finish subjected to the oxidation test. Color loss due to leaching is determined by immersing sealed specimens in 50% by volume nitric acid for 24 hours. The new anodized finish exhibited no color loss when subjected to this test. Heating can result in color loss, but this finish subjected to 450 degrees C for one hour showed little or no change in color as opposed to most integrally colored anodized finishes. Field exposure of the A44 finish in Florida, Montreal, Halifax, and Leeds, England, show no fading after 40 months.

Staining tests for color anodized aluminum is performed under ASTM

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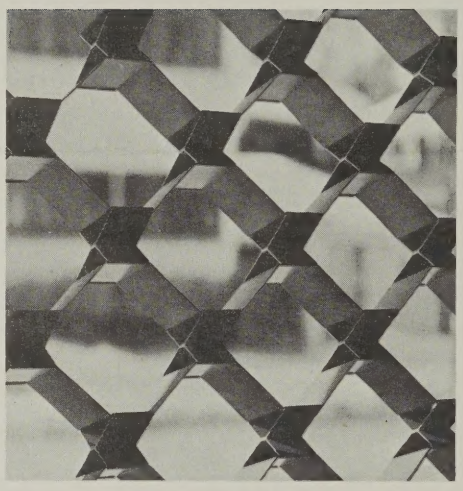
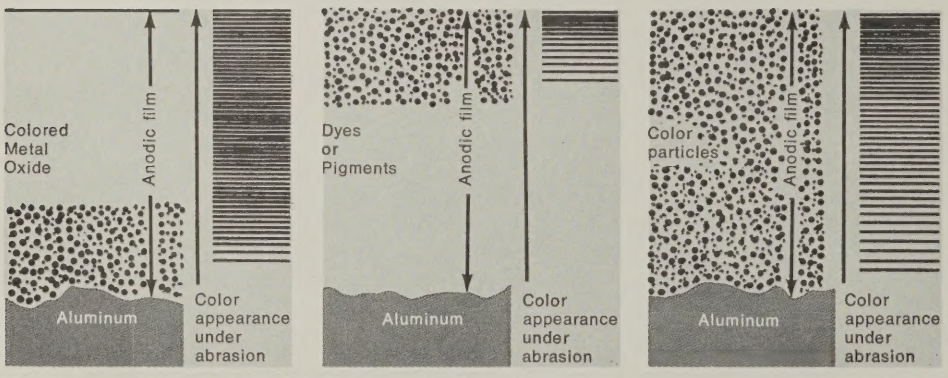
Reprinted from The Construction Specifier, October, 1971

Elegance of entrance is enhanced by anodized aluminum door frames at the Skyline Hotel, Ottawa, Ontario, Canada.

Spectacular effect is achieved by this sunscreen of anodized aluminum in a school building in Chatham, Ontario, Canada.

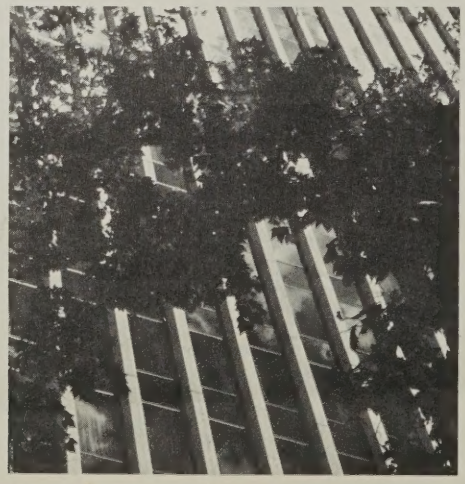




Enlargement of cross-sections shows how coating with electrolytically deposited color is protected by maximum depth of anodic film.

(Alcan Research and Development Limited)

Anodized aluminum window frames provide durable beauty to the Mutual Benefit Life Insurance building in Philadelphia's Rittenhouse Square.



B136, and this finish is capable of resisting staining by this dye drop test and show no retention of dyestuff. No staining or pitting of the finish, 1.0 mil thick, is experienced after 300 hours of the Acetic Acid-Salt Spray Test (ASTM B287) nor after 500 hours of the Neutral Salt Spray Test (ASTM B117). As with other anodic finishes a water-white non-yellowing clear methacrylate lacquer coating must be used to protect this finish against staining by mortar, cement or concrete.

Like clear anodic films formed in the sulphuric acid anodizing process, the new A44 finish has excellent resistance to abrasion in practically all architectural applications. In the few applications where thinning of the anodic coating does take place, the new anodized finish exhibits the unique characteristic of retaining all its color until the film is only about 0.2 mil thick. The reason for this behavior is that the color is located in a 0.2 mil thick layer at the base of the coating; the remaining thickness is merely clear, transparent anodic film. This behavior differs from that of dyed anodic coatings where all the color is located in the outer third or half of the film and integral finishes where the color is located uniformly throughout the thickness, since any thinning of these finishes will result in immediate color loss.

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